

Homework I (due: 02/12/2013)
CIS 9590 Ad Hoc Networks

Name _____ Student Number _____

1. (Wireless Communication: Nyquist's Theorem and Shannon's Theorem)

- Given channel bandwidth $B = 10$ GHz and noise level $SNR = 40$. Determine the maximum data rate C using Shannon's theorem.
- In order to theoretically reach the above rate, use Nyquist's theorem to determine the minimum number of discrete signal levels/voltage values used.
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2. (Channel Reuse: Cluster and Cochannel Reuse Ratio)

- Show that cluster size N have to satisfy $I^2 + IJ + J^2$ for integers I and J .
- Verify cochannel reuse ratio for $N = 9$ and $N = 12$. You are required to show the topology of the cluster and the layout structure of clusters.

3. (Coloring Problems: Harary's Theorem)

- Consider 50 states in the United States of America. Suppose any two adjacent states are "enemy" if they have the same initial of state name, otherwise, they are friends. States that are not adjacent to each other have no relationship. Can you color 50 states using two colors such that enemy states are in different colors and friend states are in the same color? Please explain your conclusion.
- Show a coloring scheme for 50 states using the minimum number of colors to meet the above criterion.

4. (Channel Assignment: Graph Coloring)

- Given a 7-cell graph with edge set $\{(A, B), (B, C), (B, F), (C, D), (D, E), (D, F), (F, G)\}$. If the channel reuse distance is $r = 2$, determine the minimum number of colors needed to color the given graph. Show the color assignment and briefly describe why the coloring scheme uses the minimum number of colors.
- If the channel reuse distance is $r = 3$, transfer the given graph to another graph with $r = 2$, and then, repeat the above step. Show all work.
- Repeat the above step for $r = 4$.